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from rust than that near the roof, but considerably cleaner than the unprepared hinge.

It is to be observed, that little rain had fallen during the time of trial.

## No. III.

## TITANIUM FOUND IN THE BUTTERLEY IRON-WORKS.

*The Thanks of the Society were voted to* JOSEPH GLYNN, *Esq. F.R.S. for his Communication on Titanium found in the Blast-furnaces at the Butterley Iron-works; Specimens of which have been placed in the Society's Repository.*

*Butterley Iron-Works, by Alfreton,*
*Derbyshire, March* 2, 1842.

SIR,

I SEND you herewith some specimens of Titanium mixed with iron, which were found in the hearth or bottom of a blast-furnace belonging to the Butterley Company, which was lately blown out, that is to say, extinguished for repairing. The hearth or cavity at the bottom of the furnace is composed of large blocks of grit-stone, of nearly pure silex, of small grain, which are found partially vitrified and rent in pieces by the heat to which they have been exposed.

The Butterley Company have six of these furnaces; they are about forty feet in height, fifteen feet inside diameter at the largest part, and each furnace produces weekly from seventy to eighty tons of best melting iron, or "No. 1 Pig."

The quantity of iron-stone is nearly three tons for each ton of iron made; so that it may be said the ironstone smelted weekly in each furnace is, in round numbers, 220 tons, and taking fifty weeks to a year, 11,000 tons of iron-stone will have been consumed by a single furnace. Each furnace may continue working without intermission for five years or more, before it requires so much repairs as to cause it to be blown out. So that 55,000 tons of iron stone, nearly an equal weight of coal, and about 18,000 tons of limestone, will have been reduced during that period. The limestone is used as a flux. The ironstone is chiefly clay combined with the metal; and although clay or lime separately are difficult of fusion, yet, when combined, they melt with comparative ease in the heat of a blast-furnace. The coal used is dry and carbonaceous, containing but little bitumen, and leaves, when burnt in the open air, a small quantity of white ashes. The quantity of titanium found in the furnace bottom or clefts of the hearth, will probably not exceed one hundred pounds weight; and although the quantity of titanium is exceedingly small in proportion to the minerals from which it is thus accidentally produced, yet it is probable that so much of this metal may not be found under other circumstances; and the chief object of my having brought this matter before the Society, is to make the members more generally acquainted with the fact that the metal in question may be obtained from the hearths of blast-furnaces in sufficient quantities for the purpose of experiment. Unfortunately, at the present moment there are too many extinct blast-furnaces. Almost one-fourth of them have been recently blown out throughout the United Kingdom. The titanium is of a brighter red colour than copper; it is almost of a rose colour. It is also more brilliant, and it does not easily tarnish. Dr. Faraday has suggested a ready method of freeing it from the iron and other impurities, by pounding the mass and dissolving the iron with sulphuric acid, which does not touch titanium when so treated, and then washing it. The beds of iron-stone found at Butterley are numerous. I send three specimens—namely, a "module," which is found in clay shale; a piece of the "Black Rake," with traces of freshwater shells in it; and a piece of the "Whatstone Rake," which is the "leanest," or poorest kind of iron-stone used in the furnaces. The beds of iron-stone are termed "rakes." The stone is calcined in heaps by mixing it with small coal and setting fire to it. All the shells found in the iron stove-beds seem to be freshwater shells; whilst in the limestone, which is the mountain lime of Crich Cliff, the shells are of marine origin. Crich is about four miles from Butterley, which is ten miles north of Derby. The coal, of which a specimen is also sent, is the "long-coal," much resembling charred wood. Unlike the Newcastle bituminous coal generally sent to the London market, which breaks in cakes, this coal can be raised from the pit in pieces ten feet long and more. I have been thus minute in detailing the quantity and kind of minerals put into the blast-furnace, that this scarce metal may be understood as existing only in minute proportions; yet it has been noticed that where it does so exist the iron is of good quality. The cast-iron is fluid, and the wrought-iron made from it strong and ductile. I send you specimens of them. The wrought-iron was bent cold. And I also send a specimen of the slag or cinder formed by the earthy parts of the iron-stone and the limestone.

I am, Sir, &c.

*W. A. Graham, Esq.* JOSEPH GLYNN.
*Secretary, &c. &c.*

*Butterley by Alfreton, Derbyshire.*
Dear Sir, *March* 21, 1842.

On Saturday night I sent by railway a box, which I hope you will receive in due time, containing specimens of minerals and the iron, both cast and wrought, obtained from them. The wrought shavings sent were turned off a bar in the lathe, and shew the tenacity of the material. I sent also an additional specimen of the titanium, and I enclose a very hasty account of the quantities used in making iron at these works of the different minerals, which I hope you will be able to make out. It is in the box with the specimens.

I am, Sir, &c.
Joseph Glynn.

*W. A. Graham, Esq.*
*Secretary, &c. &c.*

## No. IV.

## IMPROVEMENTS IN THE MANUFACTURE OF IRON.

*The Thanks of the Society were voted to Thomas W. Booker, Esq. of Melin Griffith, near Cardiff, for his Communication respecting his Patent Process of making Iron — a Model shewing the Arrangement of the Furnaces, as, also, Specimens of the Iron made by Mr. Booker's Process, have been placed in the Society's Repository.*

Sir, *Velindra House, May* 7, 1842.

I have forwarded to you this day, by the Great Western Railway from Bristol, a box containing a model and